

CLAIMS

1. An electronic shelf label comprising:
an LCD display;
a housing including a protective at least partially transparent cover layer disposed over said LCD display and in spaced relationship thereto; and
an at least partially transparent intermediate layer formed over said LCD display and substantially filling a space between said LCD display and said protective at least partially transparent cover layer.
2. An electronic shelf label according to claim 1 and wherein said at least partially transparent intermediate layer has an index of refraction which is selected so as to minimize reflection at interfaces between said at least partially transparent intermediate layer and both of said LCD display and said protective at least partially transparent cover layer.
3. An electronic shelf label according to claim 1 and wherein said at least partially transparent intermediate layer is located with respect to said LCD display and to said protective at least partially transparent cover layer so as to substantially eliminate air gaps therebetween.
4. An electronic shelf label according to claim 2 and wherein said at least partially transparent intermediate layer is located with respect to said LCD display and to said protective at least partially transparent cover layer so as to substantially eliminate air gaps therebetween.

5. An electronic shelf label according to claim 1 and also comprising at least one fuel cell powering said LCD display.

6. An electronic shelf label according to claim 5 and wherein said at least one fuel cell comprises:

at least first and second printed circuit boards, each having electrical contacts formed thereon, said electrical contacts on said first and second printed circuit boards being in at least partial registration with each other, said at least first and second printed circuit boards being formed with a plurality of apertures generally surrounded by said electrical contacts;

a plurality of electrodes, each electrode being located in one of said apertures; and

a membrane disposed between said first and second printed circuit boards, said membrane providing electrical insulation between said electrical contacts on said first and second printed circuit boards and permitting ionic transfer thereacross between said electrodes, and wherein

said electrodes located in apertures on said first printed circuit board being exposed to a fuel, and said electrodes located in apertures on said second printed circuit board being exposed to air.

7. An electronic shelf label according to claim 5 and wherein said fuel cell powering said LCD display includes a fuel tank, filling generally the volume of said housing not occupied by said display and said communicator.

8. An electronic shelf label according to claim 2 and

wherein said index of refraction is identical to the index of refraction of at least one of said LCD display and said protective at least partially transparent cover layer.

9. An electronic shelf label according to claim 2 and wherein said index of refraction varies from one surface of said intermediate layer to an opposite surface thereof.

10. An electronic shelf label system comprising:

a multiplicity of electronic shelf labels, each including an IR transmitter for transmitting information relating to the electronic shelf label;

at least one receiver receiving IR transmissions from said multiplicity of electronic shelf labels, said at least one receiver including:

an IR sensor;

a non-IR visible light sensor; and

circuitry for employing an output of the non-IR visible light sensor for reducing interference in a signal band sensed by said IR sensor.

11. An electronic shelf label system according to claim 10 and wherein each of said multiplicity of electronic shelf labels comprises:

an LCD display;

a housing including a protective at least partially transparent cover layer disposed over said LCD display and in spaced relationship thereto; and

an at least partially transparent intermediate layer

formed over said LCD display and substantially filling a space between said LCD display and said protective at least partially transparent cover layer.

12. An electronic shelf label system according to claim 11 and wherein said at least partially transparent intermediate layer has an index of refraction which is selected so as to minimize reflection at interfaces between said at least partially transparent intermediate layer and both of said LCD display and said protective at least partially transparent cover layer.

13. An electronic shelf label system according to claim 11 and wherein said at least partially transparent intermediate layer is located with respect to said LCD display and to said protective at least partially transparent cover layer so as to substantially eliminate air gaps therebetween.

14. An electronic shelf label system according to claim 12 and wherein said at least partially transparent intermediate layer is located with respect to said LCD display and to said protective at least partially transparent cover layer so as to substantially eliminate air gaps therebetween.

15. An electronic shelf label system according to claim 10 and wherein each electronic shelf label also comprises at least one fuel cell powering said LCD display.

16. An electronic shelf label system according to claim 15 and wherein said at least one fuel cell comprises:

at least first and second printed circuit boards, each

having electrical contacts printed thereon, said electrical contacts on said first and second printed circuit boards being in at least partial registration with each other, said at least first and second printed circuit boards being formed with a plurality of apertures generally surrounded by said electrical contacts;

a plurality of electrodes, each electrode being located in one of said apertures; and

a membrane disposed between said first and second printed circuit boards, said membrane providing electrical insulation between said electrical contacts on said first and second printed circuit boards and permitting ionic transfer thereacross between said electrodes, and wherein

said electrodes located in apertures on said first printed circuit board being exposed to a fuel, and said electrodes located in apertures on said second printed circuit board being exposed to air.

17. An electronic shelf label system according to claim 11 and wherein each electronic shelf label also comprises at least one fuel cell powering said LCD display.

18. An electronic shelf label system according to claim 17 and wherein said at least one fuel cell comprises:

at least first and second printed circuit boards, each having electrical contacts printed thereon, said electrical contacts on said first and second printed circuit boards being in at least partial registration with each other, said at least first and second printed circuit boards being formed with a

plurality of apertures generally surrounded by said electrical contacts;

a plurality of electrodes, each electrode being located in one of said apertures; and

a membrane disposed between said first and second printed circuit boards, said membrane providing electrical insulation between said electrical contacts on said first and second printed circuit boards and permitting ionic transfer thereacross between said electrodes, and wherein

said electrodes located in apertures on said first printed circuit board being exposed to a fuel, and said electrodes located in apertures on said second printed circuit board being exposed to air.

19. An electronic shelf label according to claim 15 and wherein said fuel cell powering said LCD display includes a fuel tank, filling generally the volume of said housing not occupied by said display and said communicator.

20. An electronic shelf label according to claim 17 and wherein said fuel cell powering said LCD display includes a fuel tank, filling generally the volume of said housing not occupied by said display and said communicator.

21. An electronic shelf label comprising:
a housing;
an electrically driven display mounted in said housing;
at least one electrically powered illuminator;
at least one fuel cell powering said electrically

driven display and said at least one electrically powered illuminator; and

a data communicator providing display data to said electrically driven display from an external data source.

22. An electronic shelf label according to claim 21 and wherein said at least one electrically powered illuminator and said electrically driven display have an average lifetime without requiring repowering of at least six months.

23. An electronic shelf label according to claim 21 and wherein said at least one fuel cell has an average mean power output of less than approximately 50 microwatts.

24. An electronic shelf label according to claim 21 and wherein said at least one fuel cell has an average peak power output of less than approximately 3 milliwatt.

25. An electronic shelf label according to claim 21 and wherein said fuel tank is fluid refuelable without requiring dismounting of said housing from a mounting location.

26. An electronic shelf label according to claim 21 and wherein at least fuel storage element of said at least one fuel cell is replaceable without requiring dismounting of said housing from a mounting location.

27. An electronic shelf label according to claim 21 and also comprising an at least partially transparent intermediate layer formed over said display and substantially filling a space

between said display and said housing.

28. An electronic shelf label according to claim 27 and wherein said at least partially transparent intermediate layer has an index of refraction which is selected so as to minimize reflection at interfaces between said at least partially transparent intermediate layer and both of said LCD display and said housing.

29. An electronic shelf label according to claim 27 and wherein said at least partially transparent intermediate layer is located with respect to said display and said housing so as to substantially eliminate air gaps therebetween.

30. An electronic shelf label according to claim 27 and wherein said index of refraction is identical to the index of refraction of at least one of said display and said housing.

31. An electronic shelf label comprising:
a housing;
an electrically driven display mounted in said housing;
at least one fuel cell powering said electrically driven display, said at least one fuel cell including a fuel tank, filling generally the volume of said housing not occupied by said display and said communicator; and
a data communicator providing display data to said electrically driven display from an external data source.

32. An electronic shelf label according to claim 31 and also comprising at least one electrically powered illuminator,

and wherein said at least one electrically powered illuminator and said electrically driven display have an average lifetime without requiring repowering of at least six months.

33. An electronic shelf label according to claim 31 and wherein said at least one fuel cell has an average mean power output of less than approximately 50 microwatts.

34. An electronic shelf label according to claim 31 and wherein said at least one fuel cell has an average peak power output of less than approximately 3 milliwatt.

35. An electronic shelf label according to claim 31 and wherein said fuel tank is fluid refuelable without requiring dismounting of said housing from a mounting location.

36. An electronic shelf label according to claim 31 and wherein at least fuel storage element of said at least one fuel cell is replaceable without requiring dismounting of said housing from a mounting location.

37. An electronic shelf label comprising:
a housing;
an electrically driven display mounted in said housing;
at least one electrically powered illuminator;
at least one replaceable energy source powering said electrically driven display and said at least one electrically powered illuminator; and

a data communicator providing display data to said electrically driven display from an external data source, said at

least one replaceable energy source being replaceable without requiring dismounting of said housing from a mounting location.

38. An electronic shelf label according to claim 37 and also comprising an at least partially transparent intermediate layer formed over said display and substantially filling a space between said display and said housing.

39. An electronic shelf label according to claim 38 and wherein said at least partially transparent intermediate layer has an index of refraction which is selected so as to minimize reflection at interfaces between said at least partially transparent intermediate layer and both of said LCD display and said housing.

40. An electronic shelf label according to claim 38 and wherein said at least partially transparent intermediate layer is located with respect to said display and said housing so as to substantially eliminate air gaps therebetween.

41. A fuel cell comprising: ^{50k} 429/32, 44 at least first and second printed circuit boards, each having electrical contacts printed thereon, said electrical contacts on said first and second printed circuit boards being in at least partial registration with each other, said at least first and second printed circuit boards being formed with a plurality of apertures generally surrounded by said electrical contacts;

a plurality of electrodes, each electrode being located in one of said apertures; and

a membrane disposed between said first and second printed circuit boards, said membrane providing electrical insulation between said electrical contacts on said first and second printed circuit boards and permitting ionic transfer thereacross between said electrodes, and wherein

said electrodes located in apertures on said first printed circuit board being exposed to a fuel, and said electrodes located in apertures on said second printed circuit board being exposed to air.

42. An electronic shelf label comprising:
a flexible electrically driven display;
at least one flexible power supply powering said electrically driven display; and
a data communicator providing display data to said electrically driven display from an external data source.

43. An electronic shelf label system comprising:
a multiplicity of flexible electronic shelf labels, each including an IR transmitter for transmitting information relating to the electronic shelf label; and
at least one receiver receiving IR transmissions from said multiplicity of flexible electronic shelf labels.

44. An electronic shelf label system according to claim 43 and wherein said at least one receiver includes:
an IR sensor;
a non-IR visible light sensor; and
circuitry for employing an output of the non-IR visible

light sensor for reducing interference in a signal band sensed by said IR sensor.

45. An electronic shelf label system according to claim 44 and wherein each of said multiplicity of electronic shelf labels comprises a flexible LCD display.

46. An electronic shelf label system according to claim 45 and wherein each electronic shelf label also comprises at least one fuel cell powering said LCD display.

47. An electronic shelf label system according to claim 46 and wherein said at least one fuel cell comprises:

at least first and second printed circuit boards, each having electrical contacts printed thereon, said electrical contacts on said first and second printed circuit boards being in at least partial registration with each other, said at least first and second printed circuit boards being formed with a plurality of apertures generally surrounded by said electrical contacts;

a plurality of electrodes, each electrode being located in one of said apertures; and

a membrane disposed between said first and second printed circuit boards, said membrane providing electrical insulation between said electrical contacts on said first and second printed circuit boards and permitting ionic transfer thereacross between said electrodes, and wherein

said electrodes located in apertures on said first printed circuit board being exposed to a fuel, and said elec-

trodes located in apertures on said second printed circuit board being exposed to air.

48. An electronic shelf label according to claim 46 and wherein said fuel cell powering said LCD display includes a fuel tank.

49. An electronic shelf label according to claim 46 and wherein said at least one fuel cell has an average peak power output of less than approximately 3 milliwatt.

50. An electronic shelf label according to claim 46 and wherein said one fuel tank is fluid refuelable without requiring dismounting of said housing from a mounting location.

51. An electronic shelf label system comprising:
a multiplicity of electronic shelf labels, each including an electronic display for displaying product information; and
a product information entry device which is operative to directly write product information to said electronic display when in propinquity thereto.

52. An electronic shelf label system comprising:
a multiplicity of electronic shelf labels, each including:

an IR receiver for receiving information relating to the electronic shelf label; and

an electronic display for displaying product information based on said information received by said IR receiver; and

at least one transmitter transmitting IR transmissions containing said information to said multiplicity of electronic shelf labels,

said at least one transmitter being characterized in that it transmits information including both price and product description.

53. An electronic shelf label system according to claim 52 and wherein said electronic display displays both said price and said product description.

54. An electronic shelf label system according to claim 53 and wherein said receiver receives said information including both price and product description.

55. An electronic shelf label system according to claim 53 and wherein said electronic display comprises a unitary LCD display.

56. An electronic shelf label system according to claim 53 and wherein said receiver receives said price information and wherein said product information is supplied to said electronic display other than via said receiver.

57. An electronic shelf label system according to claim 53 and wherein said electronic display comprises at least two separate LCD displays, at least one of which is operative to display price information received via said receiver and at least one of which is operative to display product information received other than via said receiver.

58. An electronic shelf label system according to claim 55 and also comprising a portable product information entry device which is operative to supply product information to said electronic display when in propinquity thereto.

59. An electronic shelf label system according to claim 58 and wherein said portable product information entry device is operative to receive a transmission from said transmitter including said product information and to provide said product information to said electronic display when in propinquity thereto.

60. An electronic shelf label according to claim 52 and wherein said electronic shelf labels are flexible.

61. An electronic shelf label system according to claim 58 and wherein said portable product information entry device is operative to directly write product information onto said electronic display.

62. A method of repowering an electronic shelf label including:

a housing;

an electrically driven display mounted in said housing;

at least one replaceable energy source powering said electrically driven display; and

a data communicator providing display data to said electrically driven display from an external data source,

the method comprising:

replacing said at least one replaceable

energy source without requiring dismounting of said housing from a mounting location.

63. An electronic shelf label system comprising:
a multiplicity of electronic shelf labels, each including:

an RF receiver for receiving information relating to the electronic shelf label; and

an electronic display for displaying product information based on said information received by said RF receiver; and

at least one transmitter transmitting RF transmissions containing said information to said multiplicity of electronic shelf labels,

said at least one transmitter being characterized in that it transmits information including both price and product description.

64. An electronic shelf label system according to claim 63 and wherein said electronic display displays both said price and said product description.

65. An electronic shelf label system according to claim 64 and wherein said receiver receives said information including both price and product description.

66. An electronic shelf label system according to claim 64 and wherein said electronic display comprises a unitary LCD display.

67. An electronic shelf label system according to claim 64 and wherein said receiver receives said price information and wherein said product information is supplied to said electronic display other than via said receiver.

68. An electronic shelf label system according to claim 64 and wherein said electronic display comprises at least two separate LCD displays, at least one of which is operative to display price information received via said receiver and at least one of which is operative to display product information received other than via said receiver.

69. An electronic shelf label system according to claim 66 and also comprising a portable product information entry device which is operative to supply product information to said electronic display when in propinquity thereto.

70. An electronic shelf label system according to claim 69 and wherein said portable product information entry device is operative to receive a transmission from said transmitter including said product information and to provide said product information to said electronic display when in propinquity thereto.

71. An electronic shelf label according to claim 63 and wherein said electronic shelf labels are flexible.

72. An electronic shelf label system according to claim 69 and wherein said portable product information entry device is operative to directly write product information onto said electronic display.